NASA SimLabs News

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Welcome New Subscribers!
If you are receiving this newsletter for the first time, SimLabs News is a quarterly publication reviewing current projects at the NASA Ames Simulation Laboratories (SimLabs). NASA SimLabs is comprised of three unique Flight Simulators, an Air Traffic Control radar simulator and a high fidelity Air Traffic Control Tower simulator. The facilities support government as well as private industry in a wide array of applications. To find out more, read on!

1. NASA Administrator Lands on the Moon!

NASA Administrator, Dr. Michael Griffin, was given an overview of SimLabs' capabilities in supporting the Agency exploration initiatives during his visit to Ames Research Center on December 6. 2005. Dr. Griffin flew the Lunar Lander on the Vertical Motion Simulator (VMS).

Dr. Griffin exiting the VMS cab

The demonstration used the Lander math model developed for the Apollo missions to replicate its descending control dynamics. A simulator cockpit was modified to model the interior of the Lander and a moving 3D lunar terrain was displayed through windows similar to the real Lander. Dr. Griffin controlled the simulated Lunar Lander in all six degrees of freedom via two side-arm controllers. Out-the-window terrain visual cues, and instrument displays provided vehicle positional data and recommended path of descent. The simulation demonstrated the difficulties the astronauts faced controlling the Lunar Lander while searching for a safe spot to land with limited fuel. The demonstration also underscored the benefits of training for such a task using simulation.

Dr. Griffin successfully piloted the Lunar Lander to a safe landing, was very impressed with the experience. SimLabs will make sure he has the opportunity to be the first person to land on Mars too.

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2. Lockheed Martin Continues Joint Strike Fighter Tests at SimLabs

Lockheed Martin continued evaluations of the F-35 Joint Strike Fighter (JSF) aircraft in SimLabs' Vertical Motion Simulator (VMS) by recently completing four weeks of simulation experiments. The unique motion and acceleration capabilities of the VMS are ideally suited to evaluate the handling qualities of

several variants of the F-35. The JSF is a next-generation supersonic combat aircraft designed to reduce costs by utilizing a common design with variants to meet a wide range of needs serving the U.S. Army, U.S. Air Force, U.S. Marines, as well as several international partners. Two variants were recently evaluated in the VMS: The Short Take-off Vertical Landing (STOVL) configuration and the Conventional Take-off and Landing / Carrier Variant (CTOL/CV).

F-35 in Vertical Maneuver

The STOVL configuration was the primary variant studied. This configuration required high fidelity motion cues to evaluate tasks that included bolter and ski ramp take-off. A bolter is an aborted carrier touchdown that requires full thrust to take-off after the abort. The ski ramp take-off is a short deck take-off at full thrust using a ramp at the end of the deck. Both maneuvers require high vertical acceleration cues to simulate accurately.

A secondary variant was the CTOL/CV. For this variant, most of the effort was aimed at first flight readiness and tasks such as formation flying or offset approaches requiring a high level of motion fidelity to ferret out any issues with the control system.

As part of this study, representatives from the United Kingdom Ministry of Defense evaluated a Shipboard Rolling Vertical Landing (SRVL) procedure as one more determinant in their choice between the variants mentioned above. The procedure is tied to a new aircraft carrier design under consideration and will have significant cost ramifications on the carrier design. For the SRVL procedure, touchdown dispersion and ramp clearance under various shipboard and environmental conditions were evaluated. Several aircraft controls handling issues were identified that need further investigation giving designers the opportunity to improve the system while the vehicle is still under development.

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3. How Can a Pilot Best Control a Damaged Aircraft?

Interest in adapting during flight for damaged flight controls has been around since the beginning of flight. NASA SimLabs' Advanced Concept Flight Simulator (ACFS) was used in the past by researchers from Dryden Flight Research Center (DFRC) in conducting pioneering studies of Propulsion Controlled Aircraft (PCA), where engine thrust was the primary mitigation of damaged flight controls. Researchers from DFRC recently returned to the ACFS to further develop methodologies to estimate and infer the effects of aircraft damage in simulated environments. The intent of this effort was to dramatically increase the sophistication and fidelity of existing methods by

incorporating the results of damage modeling previously performed at Dryden.

Airbus 300 Damaged Wing

The damage models estimate the effects on the aerodynamic coefficients of various types of damage to a generic Boeing 757 sized aircraft. The damage cases included wing breaks, horizontal tail section breaks and vertical tail section breaks.

ACFS aerodynamic equations were modified in such a way that any simple damage model could be introduced as a combination of scales and biases applied to coefficients. The intent was to introduce the generic effect of a damage scenario by means of scales and biases, and then attempt to establish a maximum tolerable "envelope" of this effect by varying the adjustable weighting factors. Pilots evaluated the response of the simulator under models derived from different sources.

The simulation study showed that generic transformation equation damage models can be derived from a variety of sources such as computer-based modeling tools, Computational Fluid Dynamics (CFD) analysis or wind tunnel studies. This method may prove to be a path to more sophisticated damage effects estimations and damage mitigating control schemes, including automatic control. Further studies with other aircraft models are on the horizon.

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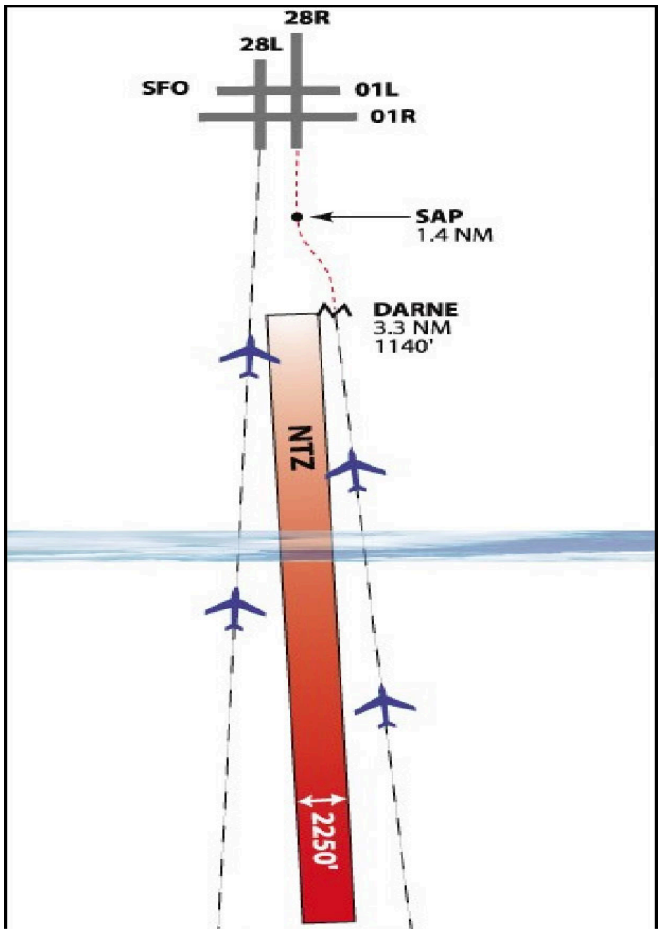
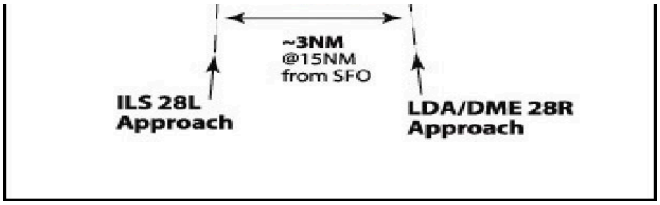
4. FAA to Test Procedures for Alternative Wake Turbulence Mitigation During Closely Spaced Parallel Approaches

The Federal Aviation Administration (FAA) and NASA Ames SimLabs are preparing wake vortex avoidance simulations for Simultaneous Offset Instrument Approach (SOIA) procedures. SOIA procedures enable simultaneous instrument approaches to airports with parallel runways spaced less than 3000 feet apart. These procedures allow improved airport efficiency and increased arrivals rates during marginal weather. With Precision Runway Monitoring (PRM), aircraft pairs on simultaneous instrument approaches are monitored by air traffic controllers, for separation, to the missed approach point. At the missed approach point, the aircrew continues the approach to the runway in visual conditions, and maintains visual separation from the aircraft on approach to the parallel runway. In this situation aircrews also apply procedures for wake vortex avoidance.



This FAA/NASA test involves the operational concept of keeping two aircraft on parallel finals within a prescribed distance or window ensuring the trailing aircraft avoids the wake



SOIA Approach

vortex of the leading aircraft. Previous safety studies conducted by the FAA and Air Traffic Simulation Inc., (ATSI) of Edmond, Oklahoma proved aircraft could avoid wake turbulence when placed closer in trail. These simulations will define and evaluate the human factors considerations for air traffic controllers to establish, monitor, and maintain the aircraft within certain distances on final, and not request flight crews to provide wake mitigation using visual separation. These factors will help determine the functional limits of the "operational window" for SOIA, and practical application of procedures for air traffic controllers.

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5. 2006 FAA/NASA/Industry Airport Planning Workshop

Mark you calendars for the 2006 FAA/NASA/Industry Airport Planning Workshop to be held September 13-14, 2006 at NASA Ames Research Center, Moffett Field, CA. Based on your feedback from the 2005 Workshop, and we are planning a program that you will find even more valuable. Visit the workshop website for periodic updates.

6. Upcoming Events

NASA SimLabs will be participating the following upcoming conferences and events. If you are attending any of these events, please look us up.

- 2006 Transportation Research Board Annual Meeting January 22-26, 2006 Washington, D.C. Mike Madson, FutureFlight Central, will participate in a panel on Perimeter Taxiways
- 2006 ACC/AAAE Airport Planning, Design and Construction Symposium Feb. 22-24, 2006 Reno, NV. Stop by NASA SimLabs' information table.

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7. Thinking of Doing Business with NASA SimLabs?

For more information on what we can do for your needs, contact:

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